| Centre Number | Candidate Number | Name |
|---|---|---|
| | | |

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

**PHYSICAL SCIENCE** **0652/02**

Paper 2

October/November 2005

**1 hour 15 minutes**

Candidates answer on the Question Paper.
No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
A copy of the Periodic Table is printed on page 16.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |
| Total | |

This document consists of **16** printed pages.

**1** **(a)** A glider is an aeroplane without an engine. Glider pilots use columns of rising warm air to lift their gliders to a greater height, as shown in Fig. 1.1.

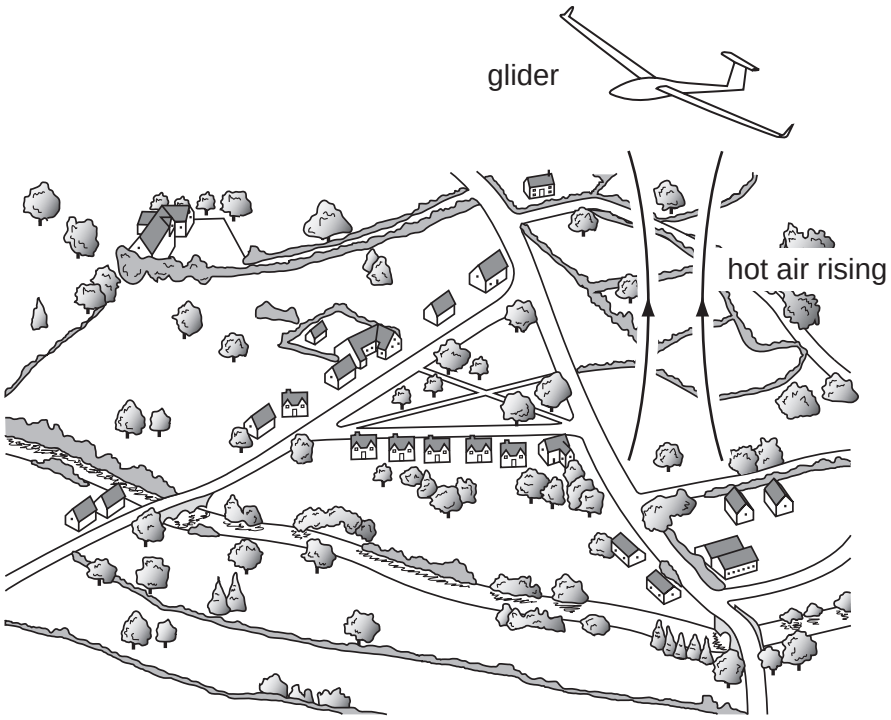


**Fig. 1.1**

**(i)** Name the process which causes the warm air to rise.

.....

**(ii)** Explain why the warm air rises.

.....

.....

..... [3]

**(b)** The warm air sometimes carries water vapour higher into the atmosphere where it changes to small water drops to form clouds.

Name the process when water vapour turns to liquid.

..... [1]

**(c)** As the water drops get larger they begin to fall. Fig. 1.2 shows a speed – time graph of the fall of one of the water drops.

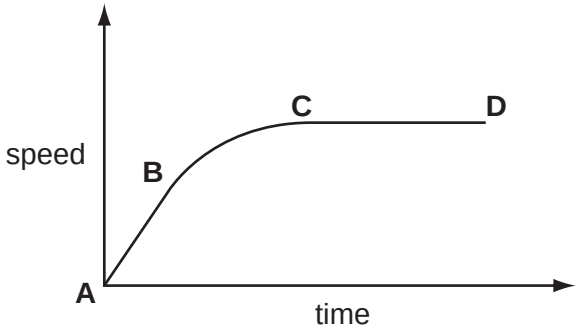


**Fig. 1.2**

**(i)** Describe the motion of the water drop between points **A** and **B**.

.....

**(ii)** Describe the motion of the water drop between points **C** and **D**.

..... [3]

**2** A coloured gas is put into the bottom of a gas-jar of air. The lid is quickly replaced on the jar. This is shown in Fig. 2.1.

After several minutes the coloured gas can be seen halfway up the jar. This is shown in Fig. 2.2.

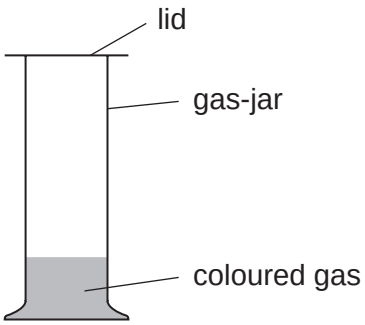


**Fig. 2.1**

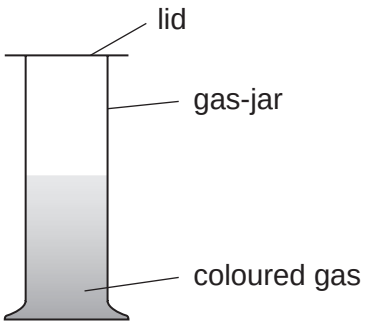


**Fig. 2.2**

**(a)** Name this process of one gas mixing slowly with another.

.....

[1]

**(b)** The molecules of the coloured gas move about quickly yet the process of mixing with the air is very slow.

Explain why the mixing is slow.

.....

.....

.....

[2]

**3** The properties of iron can be changed by the controlled use of additives to form steel alloys.

**(a)** State **one** use of mild steel.

.....

State **one** use of stainless steel.

.....

[2]

**(b)** A piece of mild steel in everyday use is protected with paint.
Stainless steel does not need this protection.
Explain this difference.

.....

.....

..... [2]

**4** In a coal-fired power station coal is burnt in a furnace. This heats water to provide steam to drive a generator.

**(a)** Complete the sentences below to explain the energy changes.

In the furnace ..... energy of the coal is converted to

.....energy in the steam. This is then converted into .....

energy at the generator. [3]

Another method of obtaining steam to drive a generator is to pump water deep into the ground. The water is heated by hot rocks.

**(b) (i)** What name is given to this type of power station?

.....

**(ii)** State **one** advantage of this method over the coal-fired power station.

..... [2]

**(c)** Explain how the generator is driven in a hydroelectric power station. In your answer refer to relevant energy changes.

.....

.....

..... [2]

**5** **(a)** A method to separate and analyse mixtures uses a vertical strip of paper dipping into a solvent.

**(i)** Name this method of separating mixtures.

..... [1]

**(ii)** Some experiments using this method require a *locating agent* to show the positions of the components.

Explain why a *locating agent* may be required.

.....

..... [1]

**(b)** Bitumen is used to make roads.

Describe how bitumen is obtained from the mixture of hydrocarbons in crude oil (petroleum).

.....

.....

..... [2]

**6** Fig. 6.1 shows the electromagnetic spectrum.

| radio waves | micro waves | infra red | visible | **P** | X-rays | gamma rays |
|---|---|---|---|---|---|---|

increasing frequency

**Fig. 6.1**

**(a)** Name the type of radiation found in the section labelled **P**.

.....

**(b)** State what happens to the speed of electromagnetic radiation, in a vacuum, as the frequency of the radiation increases.

.....

..... [2]

**(c)** The photograph in Fig. 6.2 shows a replacement joint in a person's arm.

**Fig. 6.2**

Name the part of the electromagnetic spectrum used to take this photograph.

..... [1]

**(d)** Another method of obtaining images of internal organs is to use sound waves of frequency above the human threshold of hearing.

State the maximum frequency sound that a human can hear.

..... Hz [1]





[Turn over

**7** **(a)** When ethene, $C_2H_4$, reacts with hydrogen in an addition reaction, an alkane is formed.

**(i)** Name this alkane.

..... [1]

**(ii)** Draw a diagram to show the structure of this alkane.

[1]

**(b)** When ethene, $C_2H_4$, reacts with steam in an addition reaction, an alcohol is formed.

**(i)** Name this alcohol.

..... [1]

**(ii)** Draw a diagram to show the structure of this alcohol.

[1]

**(c)** When ethene, $C_2H_4$, reacts with itself in an addition reaction, a polymer is formed.

**(i)** Name this polymer.

..... [1]

**(ii)** Draw a diagram to show the structure of this polymer.

[1]

**8** **(a)** Describe how you would carry out an experiment to find the magnetic field pattern around a bar magnet.

.....

.....

.....

.....

.....

..... [4]

**(b)** On Fig. 8.1 draw the magnetic field pattern of the bar magnet.

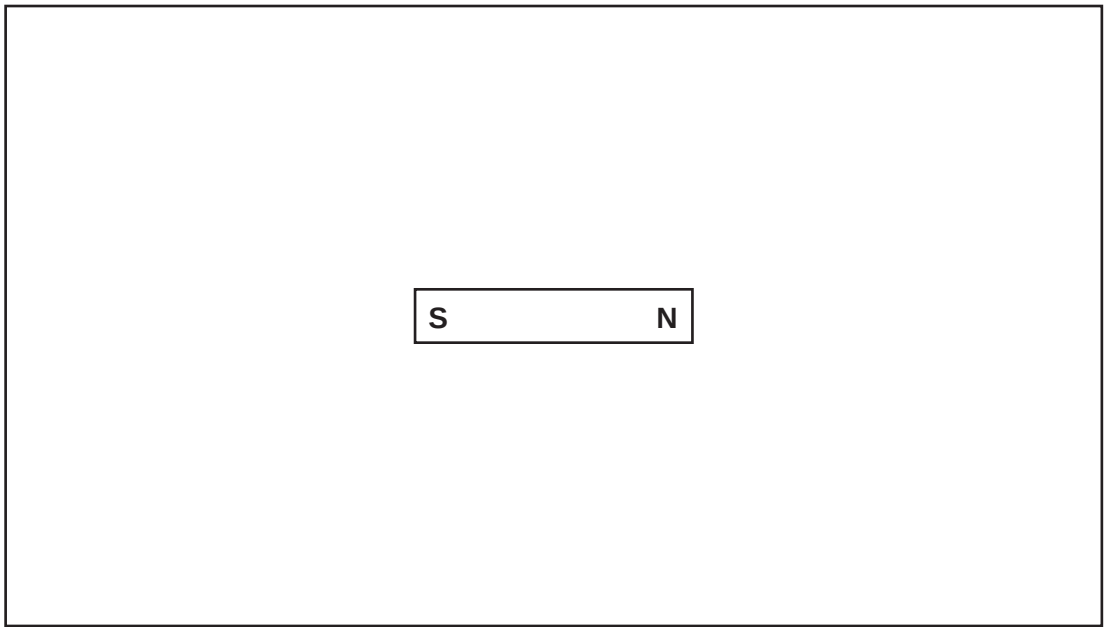


**Fig. 8.1**

[3]





[Turn over

**9** **(a)** Chlorine has two isotopes, $^{35}_{17}Cl$ and $^{37}_{17}Cl$.

Complete Fig. 9.1 for these isotopes.

| | $^{35}_{17}Cl$ | $^{37}_{17}Cl$ |
|---|---|---|
| number of protons in nucleus | 17 | |
| number of neutrons in nucleus | | 20 |
| arrangement of electrons in shells in the atom | | |

**Fig. 9.1** [3]

**(b)** Draw a diagram to show the covalent bonding in a molecule of hydrogen chloride, $HCl$

[2]

**(c)** **(i)** Describe the formation of each of the ions in sodium chloride, $NaCl$, from the elements.

.....

.....

..... [2]

**(ii)** Explain how these ions are held together in the compound.

.....

..... [1]

**(d)** Explain why sodium chloride conducts electricity when liquid but not when solid.

.....

.....

..... [2]

**(e)** Describe a chemical test for the chloride ion in solution.

test .....

result ..... [2]

**10** The noble gas, radon, is radioactive. Radon nuclei decay by emitting alpha-particles.

**(a) (i)** Explain what is meant by the term *noble gas*.

.....

.....

**(ii)** Explain what is meant by the term *alpha-particle*.

.....

..... [3]

**(b)** Complete the equation which shows the decay of a nucleus of radon-220.

$$^{220}_{86}\text{Rn} \longrightarrow \begin{matrix}\cdots\cdots\\ \cdots\cdots\end{matrix}\text{Po} + \begin{matrix}\cdots\cdots\\ \cdots\cdots\end{matrix}\alpha\ \text{(alpha)}$$

[2]

**(c)** A sample consists of 36.0 μg of radon-220. After a period of 3 minutes only 4.5 μg of radon-220 remained.

Calculate the half-life of radon-220. Show your working.

half-life = ..... minute(s) [3]

**11** Carbon monoxide and oxides of nitrogen are common pollutants of air.

Describe how each pollutant is formed.

carbon monoxide .....

.....

.....

oxides of nitrogen .....

.....

..... [4]

**12 (a) (i)** State the main method to obtain calcium oxide (lime) from calcium carbonate (limestone).

..... [1]

**(ii)** Complete the equation for this process.

$CaCO_3 \longrightarrow$ ..... + .....

[2]

**(iii)** The energy required to break the bonds in calcium carbonate is greater than the energy released when the products are formed.

What does this show about the total energy change in the reaction?

.....

..... [1]

**(iv)** Describe a test to identify the gas produced in this process.

test .....

result ..... [2]

**(b)** Calcium hydroxide (slaked lime) is used to treat acidic industrial waste products.

Name the main chemical process involved in this treatment.

..... [1]





[Turn over

**13** Fig. 13.1 shows two types of switch that can be used to control an electric light.

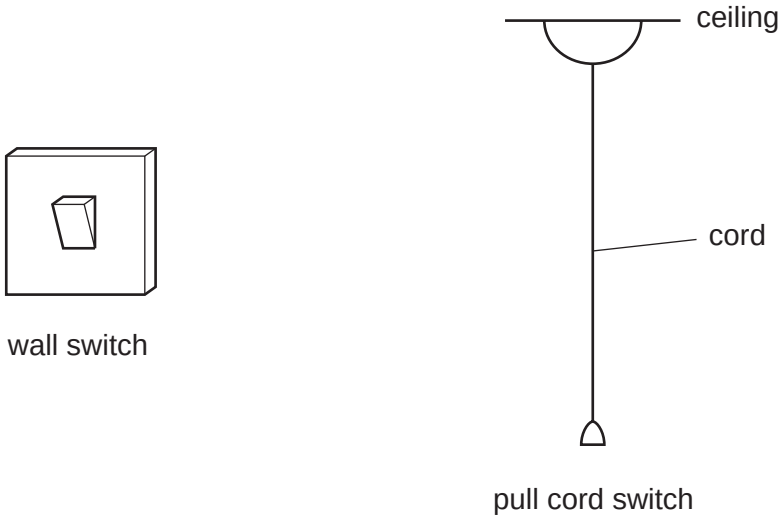


**Fig. 13.1**

**(a)** Explain why a pull-cord switch, not a wall switch, should always be used in a bathroom or shower-room.

.....

.....

..... [3]

**(b)** Fig. 13.2 shows part of a circuit that could be used to operate lights in a room.

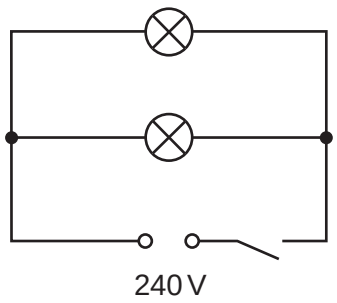


**Fig. 13.2**

The two lamps are identical and each takes a current of 0.25 A.

**(i)** Calculate the resistance of each lamp. Show your working and include the unit.

resistance = ..... [3]

*For Examiner's Use*

**(ii)** What is the total current taken from the supply when both lamps are switched on?

current ..... A [1]

# DATA SHEET
## The Periodic Table of the Elements

| Group | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | II | | | | | | | | | | III | IV | V | VI | VII | 0 |
| | | | | | | | 1 H Hydrogen 1 | | | | | | | | | 4 He Helium 2 |
| 7 Li Lithium 3 | 9 Be Beryllium 4 | | | | | | | | | | 11 B Boron 5 | 12 C Carbon 6 | 14 N Nitrogen 7 | 16 O Oxygen 8 | 19 F Fluorine 9 | 20 Ne Neon 10 |
| 23 Na Sodium 11 | 24 Mg Magnesium 12 | | | | | | | | | | 27 Al Aluminium 13 | 28 Si Silicon 14 | 31 P Phosphorus 15 | 32 S Sulphur 16 | 35.5 Cl Chlorine 17 | 40 Ar Argon 18 |
| 39 K Potassium 19 | 40 Ca Calcium 20 | 45 Sc Scandium 21 | 48 Ti Titanium 22 | 51 V Vanadium 23 | 52 Cr Chromium 24 | 55 Mn Manganese 25 | 56 Fe Iron 26 | 59 Co Cobalt 27 | 59 Ni Nickel 28 | 64 Cu Copper 29 | 65 Zn Zinc 30 | 70 Ga Gallium 31 | 73 Ge Germanium 32 | 75 As Arsenic 33 | 79 Se Selenium 34 | 80 Br Bromine 35 | 84 Kr Krypton 36 |
| 85 Rb Rubidium 37 | 88 Sr Strontium 38 | 89 Y Yttrium 39 | 91 Zr Zirconium 40 | 93 Nb Niobium 41 | 96 Mo Molybdenum 42 | Tc Technetium 43 | 101 Ru Ruthenium 44 | 103 Rh Rhodium 45 | 106 Pd Palladium 46 | 108 Ag Silver 47 | 112 Cd Cadmium 48 | 115 In Indium 49 | 119 Sn Tin 50 | 122 Sb Antimony 51 | 128 Te Tellurium 52 | 127 I Iodine 53 | 131 Xe Xenon 54 |
| 133 Cs Caesium 55 | 137 Ba Barium 56 | 139 La Lanthanum 57 * | 178 Hf Hafnium 72 | 181 Ta Tantalum 73 | 184 W Tungsten 74 | 186 Re Rhenium 75 | 190 Os Osmium 76 | 192 Ir Iridium 77 | 195 Pt Platinum 78 | 197 Au Gold 79 | 201 Hg Mercury 80 | 204 Tl Thallium 81 | 207 Pb Lead 82 | 209 Bi Bismuth 83 | Po Polonium 84 | At Astatine 85 | Rn Radon 86 |
| Fr Francium 87 | 226 Ra Radius 88 | 227 Ac Actinium 89 | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 144 Nd Neodymium 60 | Pm Promethium 61 | 150 Sm Samarium 62 | 152 Eu Europium 63 | 157 Gd Gadolinium 64 | 159 Tb Terbium 65 | 162 Dy Dysprosium 66 | 165 Ho Holmium 67 | 167 Er Erbium 68 | 169 Tm Thulium 69 | 173 Yb Ytterbium 70 | 175 Lu Lutetium 71 |
| 232 Th Thorium 90 | Pa Protactinium 91 | 238 U Uranium 92 | Np Neptunium 93 | Pu Plutonium 94 | Am Americium 95 | Cm Curium 96 | Bk Berkelium 97 | Cf Californium 98 | Es Einsteinium 99 | Fm Fermium 100 | Md Mendelevium 101 | No Nobelium 102 | Lr Lawrencium 103 |

*58-71 Lanthanoid series
90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 $dm^3$ at room temperature and pressure (r.t.p.).